Air Toxic Risk Assessment Modeling Tools Symposium: Site Specific Assessments including Residual Risk (Perchloroethylene Dry Cleaning)

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U.S. EPA / OAQPS

Residual Risk Reviews

- The CAA also requires that a **residual risk** rule be promulgated, if necessary, nine years after the promulgation of the MACT.
- For PCE Dry Cleaning this deadline was September 22, 2002.
- EPA is in the process of conducting the assessment for PCE dry cleaning source category

Industry Background

- More than 25,000 PCE dry cleaners exist (1991)
- Majority of PCE dry cleaners emit <10 tons/yr of PCE
- Approximately 25 that were subject to MACT have been identified
  - Of these, approximately 14 are currently operating at major source levels
- Many are in close proximity to residences and/or schools

The Residual Risk Test

- Is conducted at project startup
- Start with a “risk test” to screen out source category, sources, pollutants as “low-risk”
- Not used to require a residual risk rule

Residual Risk Test Approach

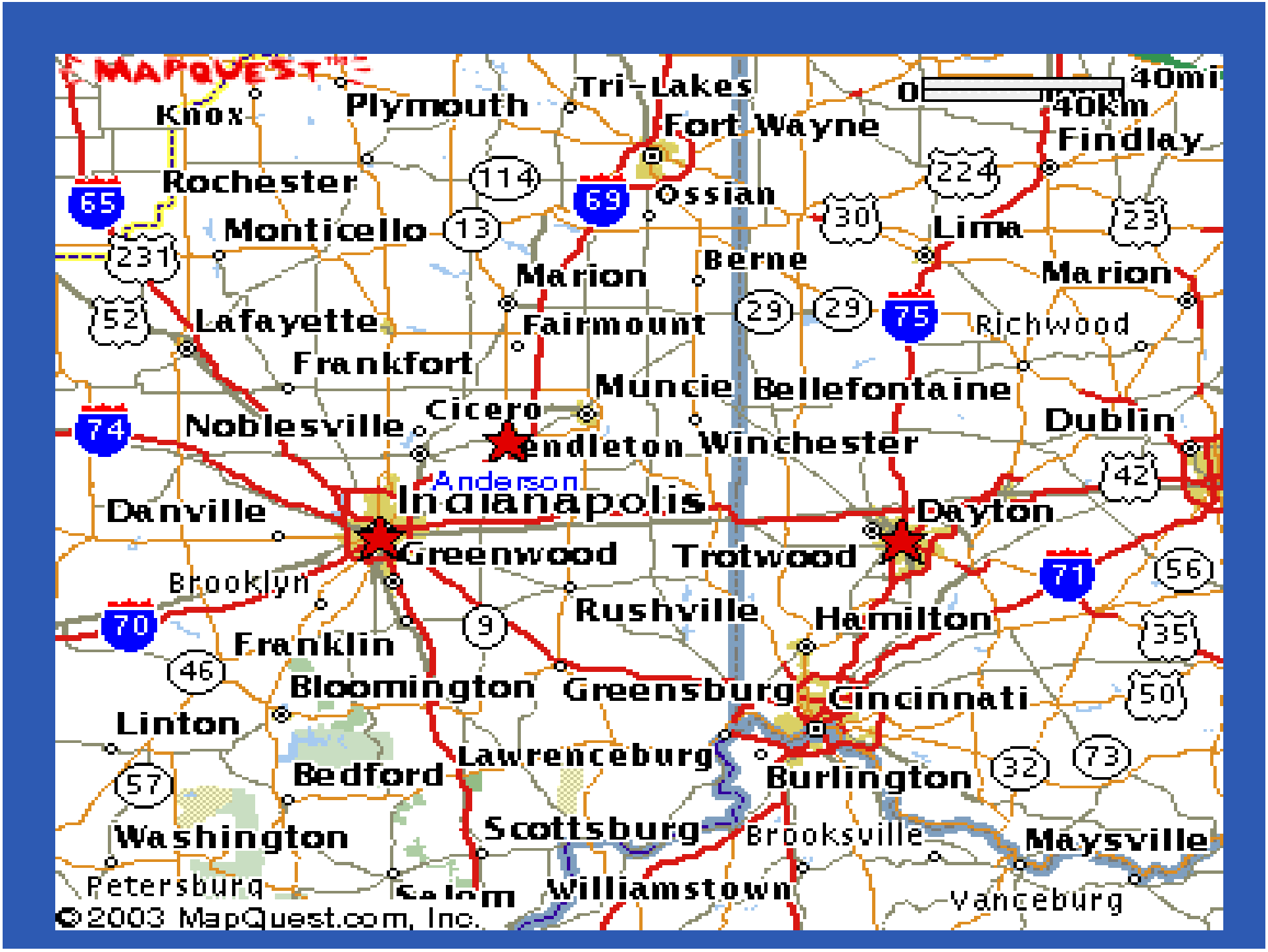
- It was conducted for a single dry cleaning facility in Anderson, Indiana -chosen for it's high annual consumptions/emissions of PCE and it's proximity to residential areas.
- Looked at a single HAP (PCE)
- It focused on human health - estimating the emissions' potential to create cancer and non-cancer risks.
- Performed site-specific risk assessment

Data Sources

- Site-specific emissions, source characteristics, and facility layout data came primarily from the facility's own records.
- Latitude and longitude of the facility structure, the property lines, and the emission sources were confirmed with GPS readings during site visit.
- Data on location of nearby residences collected during site visit

Anderson Facility Background

- 3 PCE dry-to-dry machines
  - Annual PCE usage: 12,164 gallons
  - Range of PCE usage for identified major sources: 2,100 – 12,600 gallons
- Two primary emission points
  - PCE machine emission stack (VIC Stack)
    - Carbon absorbers as control devices; no refrigerated condensers associated with carbon absorber
  - Room exhaust fan near PCE machines
- Facility has residences located as close as 52 feet from facility !!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PCE Facility
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N Raible Av
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N Shore Blvd
Northshore Blvd
Moss Island Rd
Short Hazlett St
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PCE Facility
USGS


PCE Facility
USGS

The Facility

Photos of process

The Facility

Photos of facility layout


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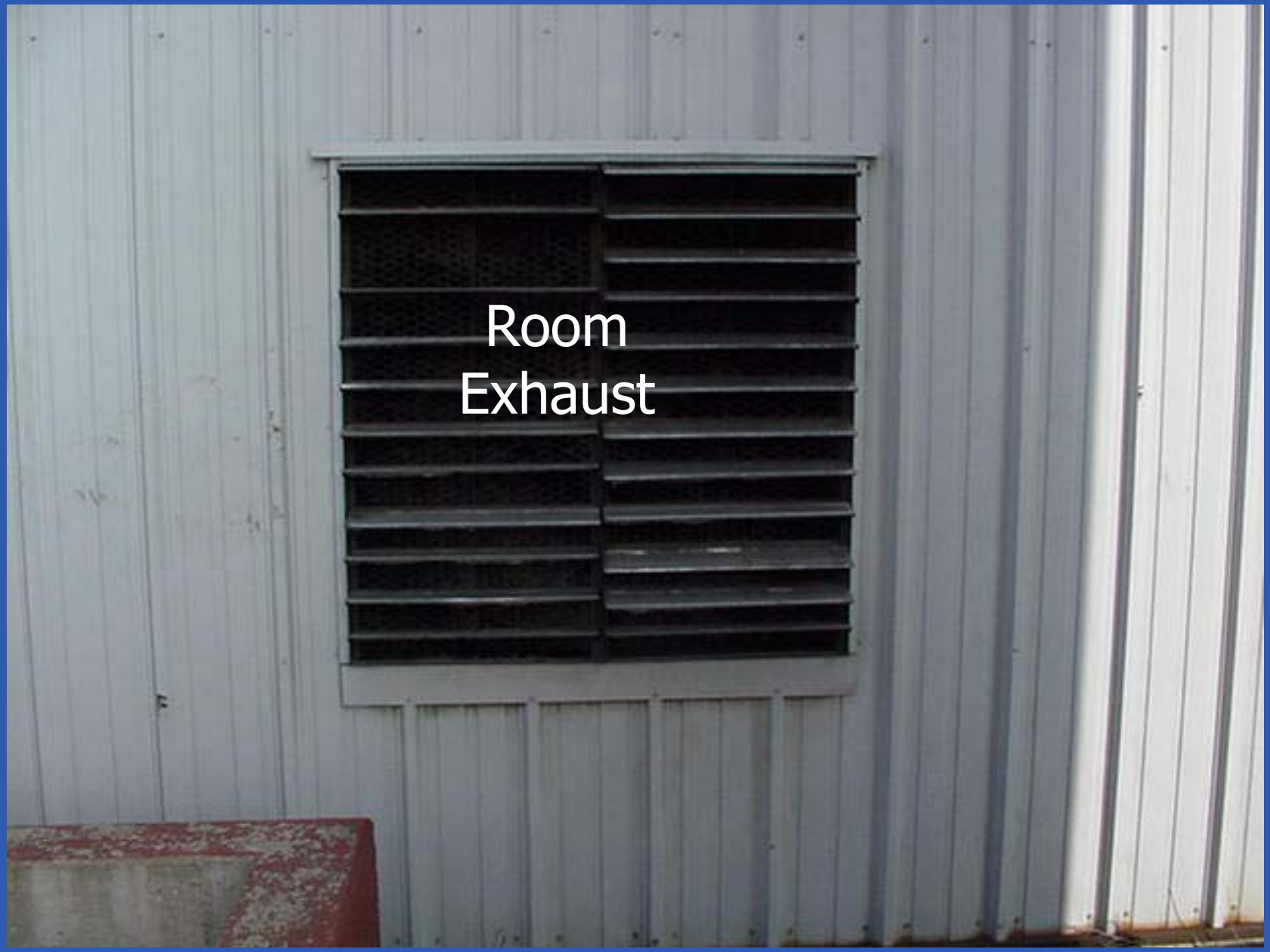
VIC Stack


Room
Exhaust


Room
Exhaust
PERCHLOROETHYLENE
GARMENT SERVICES


Nearby
Residence


Nearby
Residence

Selected the Industrial Source Complex Short-Term Model

- Facility proximity to residential areas
- Associated buildings and emission sources are relatively complex
- Can simulate emissions from point and area sources

The Emission Points

PCE emissions were modeled by the ISCST3 model from two emissions points

1. A stack that exhausts from the carbon absorber (VIC Stack)
2. A 4'x4' room exhaust fan located along the side wall of the building, near the PCE dry cleaning machines

Note: Since the room exhaust fan has a flow rate >15m^3/s, other potential emissions through open windows or doors will be minimal.

Characterizing the Emission Points for Dispersion Modeling

- The VIC stack
  - Modeled as a point source 2 feet above the roofline
- The room exhaust vent discharged horizontally at a relatively high exit velocity approximately 3 ft. above the ground along the SW sidewall of the building
  - The source was modeled as a 16'x8' area source, located 3 ft. above ground

VIC Stack Inputs to ISCST3 Model

- Model Representation: Point
- Height: 7.92 m
- Diameter: .457 m
- Gas exit velocity: 10.1 m/s
- Gas temperature: 305 K
- Gas flow rate: 1.65 m^3/s
- PCE emissions: 0.47 g/s

Room Exhaust Inputs to ISCST3 Model

- Model Representation: Area
- Area source size: 4.9m x 2.4m
- Area source elevation: 0.90 m
- Flow rate: 15.56m^3/s
- PCE emissions: 1.44 g/s

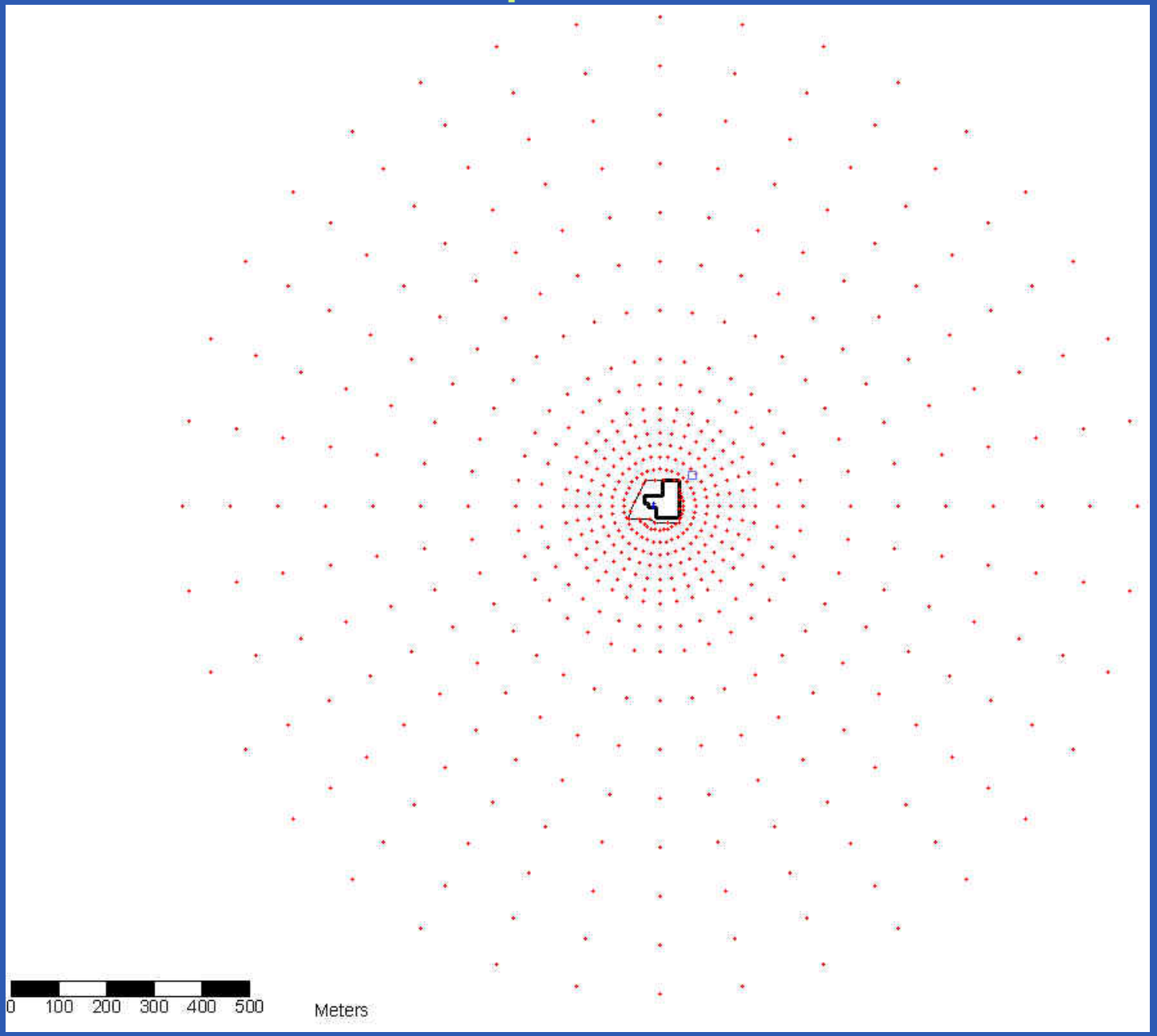
Meteorology Data

- Compiled from a five year data set (1987-1991)
  - Surface data from Indianapolis NWS (35 mi. SW of the facility)
  - Upper air data from Dayton, OH NWS (80 mi. SE of the facility)

Modeling Receptors

- Fenceline Receptors - 20 receptors were placed along the facility property line at a spacing of 25 meters
- Polar grid - 16 distances (50 to 1000 meters)
- No terrain elevation was considered because the surrounding terrain was relatively flat
- Residences adjacent to the east end of the property were characterized using the nearest polar grid receptor

Receptor Locations



ISCST3 model options employed in this study:

- Calculations: Annual Average
- Source Type: Point, Area
- Receptor Orientation: Polar, Discrete
- Terrain: Flat
- Dispersion Coefficient: Rural
- Regulatory Default: Yes
- Building Effect Downwash Yes
- Meteorology: Surface Data – Indianapolis, IN
  Upper Air Data – Dayton, OH

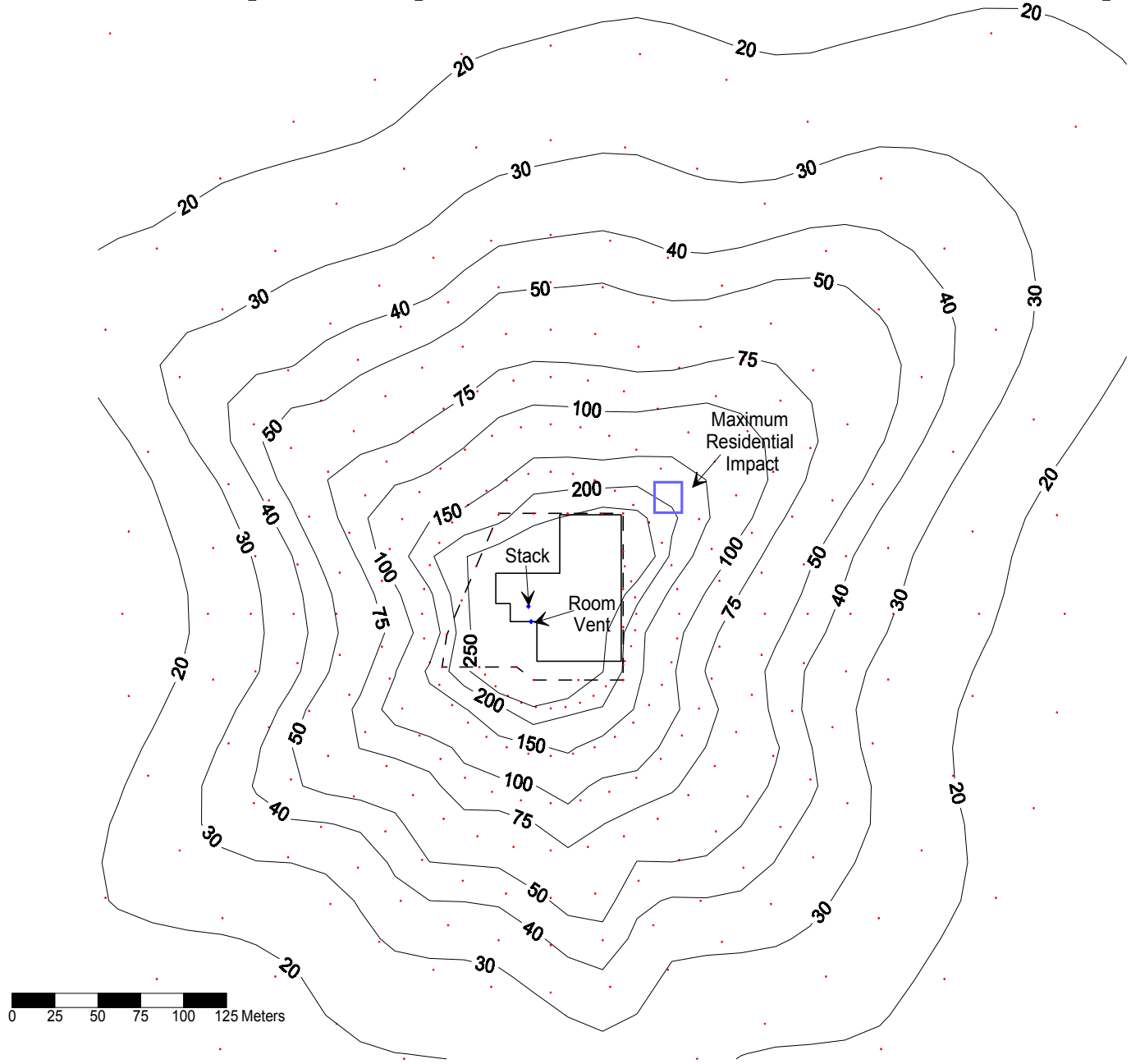
Dispersion Modeling Results

- A PCE concentration of 230 ug/m^3 at a nearby residence
- PCE concentrations of 30 ug/m^3 or greater at location of homes as far away as 300m
- Exhaust vent is the source of more than 90% of the risk

ISCST Model Results

Model Year	PCE Conc. At Residence ($\mu g/m^3$)
– 1987	257
– 1988	223
– 1989	226
– 1990	242
– 1991	218
–5-yr Avg:	233

Annual (1987) PCE Concentrations ($\mu g/m^3$)



Risk Assessment Results: Cancer

- Used a unit risk estimate (URE) range for PCE of 7.2×10^{-8} to 5.9×10^{-6} per ug/m3
  - Encompasses range proposed in EPA IRIS document and California EPA's current URE
  - EPA URE range is undergoing external review
- A 230ug/m^3 lifetime exposure level yields a risk range of 17 in a million to 1400 in a million

Risk Assessment Results: Non-Cancer

- Used a reference concentration (RfC) range for PCE of 35ug/m^3 to 270ug/m^3
  - Range is the California EPA reference exposure level (REL) (35ug/ m^3) to the ATSDR minimum risk level (MRL) for PCE (270ug/ m^3)
- At modeled PCE concentration of 230 ug/m^3, the hazard quotient (HQ) ranges from 0.8 to 7

The Big Picture

- The EPA conducted a residual risk test for the PCE dry cleaning source category.
- Cancer risks in the vicinity of one large PCE dry cleaner are significantly higher than 1 in a million.
- At this time, the EPA lacks sufficient data to remove PCE dry cleaning from consideration of a residual risk rule.

Next Steps

- Options for reducing risks at area source PCE dry cleaners will also be considered.
- EPA is in the data gathering stage of this regulatory development.
- Regulatory alternatives (risk reduction/control options) have not yet been determined.
- EPA is working with state/local agencies and communities on an ambient monitoring program to evaluate modeling.